

Hydraulic Fracturing; Silica Exposure Risk for Natural Gas Workers



Hydraulic fracturing or “fracking” for natural gas has expanded in its geographical scope in recent years due to more efficient, cost-effective technology. However, various processes associated with this method of natural gas extraction are likely to expose workers to airborne crystalline silica or *silica dust*. This paper discusses hazards presented by worker exposure to silica dust during hydraulic fracturing, regulatory action and recommendations and means to protect workers who risk silica dust overexposure.

Process, Operations and Scope

Hydraulic fracturing has been used for hydrocarbon recovery for decades, but has become widespread in North America due to a modern process known as horizontal slickwater fracking, as well as other technologies that provide more efficient access to oil and gas deposits. Pressurized fluid and sand are injected via drilled wellbores into shale formations, causing rock fractures that allow natural gas and petroleum to be released and collected.

Crystalline silica, A.K.A *frac sand*, is used as part of the mix that is injected into wells for hydrocarbon recovery. Frac sand acts as a proppant, or means of holding open fractured rock to allow access to oil and natural gas for extraction. Thousands of pounds of sand are transported to well sites, then conveyed and blended with fracking fluids before high-pressure injection; all of these processes can expose well site workers to respirable silica dust.

Silica Exposure & Silicosis Risk to Workers

Workers who are exposed to high levels of respirable crystalline silica may be at risk for silicosis, an occupational lung disease. Symptoms may take years to develop and include inflamed lungs, severe shortness of breath, cough, fever, and weight loss. Scarring lesions reduce the lung’s oxygen intake ability, and can result in susceptibility to tuberculosis, chronic bronchitis and even death in acute cases. Silicosis has no cure.

In 2012, the National Institute for Occupational Safety and Health (NIOSH) released field study findings concerning worker overexposure to airborne silica during hydraulic fracturing operations. Air samples were collected at 11 North American hydraulic fracturing sites with the following results of 116 samples collected:*

- 47% showed silica exposures greater than the calculated OSHA PEL.
- 79% showed silica exposures greater than the NIOSH REL of 0.05 milligrams per cubic meter (mg/m³).
- 9% of all samples showed silica exposures 10 or more times the PEL, with one sample more than 25 times the PEL.
- 31% of all samples showed silica exposures 10 or more times the REL, with one sample more than 100 times the REL.

Regulatory Action and Operator Recommendations

NIOSH reported their findings to hydraulic fracturing operators, along with recommendations as to site evaluation and control of crystalline silica exposure. Those measures included dust reduction through capping unused sand mover fill ports, fresh water application around well sites and limiting time spent by workers in dusty areas. Other recommended practices include enclosure of dust release areas and use of installed dust collection and ventilation systems.

The Occupational Health and Safety Administration (OSHA) has established a Permissible Exposure Limit (PEL) stating maximum worker exposure to crystalline silica during an eight-hour work shift (29 CFR 1926.55, 1910.1000), as well as the National Emphasis Program (NEP) for Crystalline Silica exposure intended to “identify, reduce, and eliminate health hazards associated with occupational exposures.”**

Respiratory Protection for Workers

If silica dust exposure levels have been determined to be a workplace hazard at a given site, OSHA 29 CFR 1910.134 Respiratory Protection Standard requires that employers provide correct, NIOSH-approved respirators as well as respirator fit testing, training and medical evaluations. Basic respirator guidelines include use of an N95 NIOSH-certified respirator for crystalline silica airborne exposures at concentrations less than or equal to 0.5 milligrams per cubic meter of air (mg/m³) **. Silica levels exceeding 0.5 mg/m³ require use of a full-facepiece respirator that provides protection for up to 2.5 milligrams per cubic meter of air (mg/m³).

For additional protection and comfort, a PAPR equipped with high-efficiency filters and tight-fitting facepiece may also be used within concentrations of up to 2.5 mg/m³. When working within environments with concentrations of up to 25 mg/m³, a supplied-air respirator in pressure-demand or positive-pressure mode may be used. A Type CE supplied-air

respirator is also appropriate for abrasive blasting applications. Lastly, any environment where concentration is unknown or is above 25 mg/m³, a self-contained breathing apparatus (SCBA) is required. ****

Workers are also advised to take personal protective measures such as showering and changing clothes before leaving work sites, and keeping informed as to health screening opportunities. Eating and drinking should be avoided within dusty work areas; cigarette smoking exacerbates lung damage that is due to silica dust overexposure. ***

For the latest silica-related information, exposure limits and regulations, please visit NIOSH at www.cdc.gov/niosh/npg/ to view the *NIOSH Pocket Guide to Chemical Hazards*.

MSA Recommended Respiratory PPE for Hydraulic Fracturing Applications

- Advantage® 200 LS and 400 Series Half-Mask Respirators (NIOSH-approved) and Advantage Cartridges offer unmatched fit and comfort with AnthroCurve™ Sealing Surface. Patented MultiFlex® System equalizes face seal area pressure with exceptional stability.
- Advantage Cartridge P100 (HE high-efficiency) and N95 particulate filters are offered in both stand-alone and combination models for use with Advantage Respirators and are NIOSH-approved.
- Advantage 3000 and 4000 Series Full-Face Respirators (NIOSH-approved); facepieces offer scratch-resistant lens and superior visibility.
- OptimAir® TL Powered Air-Purifying Respirator (NIOSH-approved) provides protection against particulates, toxic gases and vapors with all components packaged in a single housing. Flow rates are set via built-in sensors; automatic altitude adjustment uses internal pressure sensor.
- Abrasi-Blast™ Supplied Air Respirator provides respiratory and upper body protection for personnel engaged in abrasive blasting. Assembly includes hood, face piece with lens housing, breathing tube, lens cartridge, flow-control device, air-supply hose, and support belts.

* OSHA NIOSH Hazard Alert DTSEM 6/2012 Worker Exposure to Silica during Hydraulic Fracturing

** NIOSH Respiratory Protection Recommendations for Airborne Exposures to Crystalline Silica

*** OSHA, Crystalline Silica Exposure Health Hazard Information

**** NIOSH Pocket Guide to Chemical Hazards

For additional information, visit www.silica-safe.org.

Our Mission

MSA's mission is to see to it that men and women may work in safety and that they, their families and their communities may live in health throughout the world.

MSA: Because every life has a purpose.

Note: This bulletin contains only a general description of the products shown. While uses and performance capabilities are described, under no circumstances shall the products be used by untrained or unqualified individuals and not until the product instructions including any warnings or cautions provided have been thoroughly read and understood. Only they contain the complete and detailed information concerning proper use and care of these products.



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